Thin film nanostructured materials based on mesogenic mix-substituted phthalocyanines

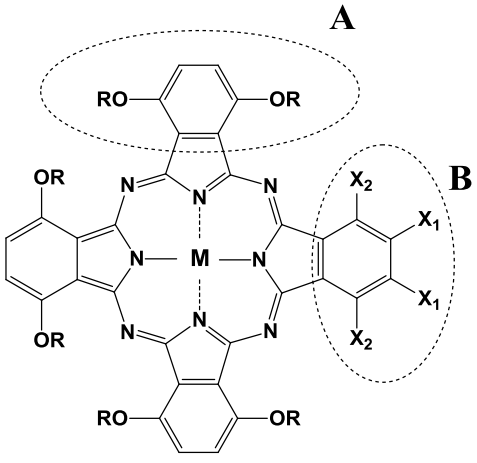
N.V. Usol'tseva[1], A.I. Smirnova[1], A.V. Kazak[1*], E.G. Glukhovskoy[2]

[1]*Nanomaterials Research Institute, Ivanovo State University, Ivanovo, Russia*
[2]*National Research Saratov State University, Saratov, Russia*

**e-mail alexkazak86@gmail.com*

Since the middle of the last century, when the solar batteries were created on the base of monocrystalline silicon the researchers on their improving have been continuing. Ultimately, the power conversion efficiency has reached 25%. Since these devices have a number of disadvantages, the scientists focus their attention on getting cheaper and more efficient materials, such as organic semiconductors. They include heterocyclic compounds and discotic mesogens the molecules of which can be arranged in columns that increases the charge transfer. To improve their efficiency, the compositions with organic semiconductors and glass polymers are usually used. Thin film semiconductor materials must be possessed of special physicochemical properties: harvesting of a significant fraction of the solar spectrum with a high molar extinction coefficient, a significant difference in energy between the HOMO / LUMO, the material should be vitrified, optimally in the mesophase.

The report is dedicated to the synthesis and physical and chemical properties of new discotic mesogens – phthalocyanine derivatives and their metal complexes, which can satisfy all the above mentioned requirements. The preparation of thin film nanomaterials based on these phthalocyanines, as well as data on optical and photovoltaic properties of films are described there. Substitution in one molecule by donor and acceptor groups creates unique conditions to form the charge-transfer complexes. It gives special properties to compounds in bulk and thin films. It is shown that all compounds tested (see Figure 1), except for indium complex exhibit thermotropic mesomorphism, type of which depends on the number of chlorine atoms and length of alkyloxy substituents introduced into phthalocyanine molecule. On the basis of the results obtained, we can assume that above mentioned compounds can be used in optical, nanoelectronic and organic photovoltaic devices.



R = C_nH_{2n+1}, n = 8, 16

Ia: M = $2H^+$, X_1 = Cl, X_2 = H

Ib: M = Cu^{2+}, X_1 = Cl, X_2 = H

Ic: M = Zn^{2+}, X_1 = Cl, X_2 = H

Id: M = InCl, X_1 = Cl, X_2 = H

IIa: M = $2H^+$, X_1 = X_2 = Cl

IIb: M = Cu^{2+}, X_1 = X_2 = Cl

IIc: M = Zn^{2+}, X_1 = X_2 = Cl

Figure 1. Structural formula of studied mix-substituted phthalocyanines of A_3B type

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